

# A New Model for Market-Based Regulation of Subnational Borrowing

## The Mexican Approach

*Marcelo Giugale*

*Adam Korobow*

*Steven Webb*

To bring fiscal discipline to state and municipal governments, Mexico's federal government has established a two-pillar framework that explicitly renounces federal bail-outs and establishes a Basel-consistent link between the capital-risk weighting of bank loans to subnational governments and the borrower's credit rating. Whether the framework succeeds will depend partly on market assessments of the government's commitment to enforce bank capital rules and refrain from bailing out defaulting subnational governments.

The World Bank  
Latin America and the Caribbean Region  
Mexico Country Department  
and  
Poverty Reduction and Economic Management Sector Unit  
July 2000



## Summary findings

Faced with weak subnational finances that pose a risk to macroeconomic stability, Mexico's federal government in April 2000 established an innovative incentive framework to bring fiscal discipline to state and municipal governments.

That framework is based on two pillars: an explicit renunciation of federal bail-outs and a Basel-consistent link between the capital-risk weighting of bank loans to subnational governments and the borrower's credit rating.

In theory, this new regulatory arrangement should reduce moral hazard among banks and their state and

municipal clients; differentiate interest rates on the basis of the borrowers' creditworthiness; and elicit a strong demand for institutional development at the subnational level.

But its success will depend on three factors critical to implementation:

- Whether markets find the federal commitment not to bail out defaulting subnational governments credible.
- Whether subnational governments have access to financing other than bank loans.
- How well bank capital rules are enforced.

---

This paper — a product of the Mexico Country Department and Poverty Reduction and Economic Management Sector Unit, Latin America and the Caribbean Region — is part of a larger effort in the region to understand the subnational underpinnings of sustainable, national economic framework. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Michael Geller, room I4-142, telephone 202-458-5155, fax 202-522-2093, email address [mgeller@worldbank.org](mailto:mgeller@worldbank.org). Policy Research Working Papers are also posted on the Web at [www.worldbank.org/research/workingpapers](http://www.worldbank.org/research/workingpapers). The authors may be contacted at [mgiugale@worldbank.org](mailto:mgiugale@worldbank.org), [akorobow@worldbank.org](mailto:akorobow@worldbank.org), or [swebb@worldbank.org](mailto:swebb@worldbank.org). July 2000. (25 pages)

*The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the view of the World Bank, its Executive Directors, or the countries they represent.*

**COMMENTS WELCOME**

**A New Model for Market-based Regulation of Subnational Borrowing:  
The Mexican Approach**

**Marcelo Giugale , Adam Korobow, and Steven Webb <sup>1/</sup>**

***JEL Classification: H74***

1/ Giugale is the Lead Economist of the World Bank's Mexico Country Department. Korobow is a Research Associate at the same department. Webb is a Senior Decentralization Specialist at the World Bank's Vice-Presidency for Latin America and the Caribbean.



## **A New Model for Market-based Regulation of Subnational Borrowing: The Mexican Approach**

### **Introduction**

Much as defaults on commercial banks' liabilities (in particular, deposits) carry systemic costs that far out-weigh private considerations, the liabilities of sub-national governments in federal systems can also generate large, negative externalities for the country as a whole. While those governments have a constitutional right to manage their own finances, including borrowing decisions, the cost of their financial performance is spread to other states, to the federal government and, sometimes, even to other countries. The experience of the Brazilian state of Minas Gerais in January 1999 is a clear example of the wedge between a single state's private cost of default and the economy- and region-wide social cost of that default.<sup>1</sup> There is, in other words, a public good case for regulating sub-national borrowing.

While the externalities involved in commercial banking have led to a well-developed regulatory practice (and literature), relatively less is known or commonly accepted about sub-national borrowing regulation, especially in developing countries.<sup>2</sup> This dearth of knowledge is odd as, in those countries, the bulk of the sub-national borrowing is financed by domestic banks, leading to an important second-order externality implicit in state defaults. In principle, a large state's reneging from its bank debt

---

<sup>1</sup> See for example, "Brazil's Government Pays Foreign Debt Owed by One of Its States," *The New York Times*, February 11, 1999, Thursday.

<sup>2</sup> Taken together, Ter-Minassian and Craig (1997), Freire and Huertas (1999), and Dillinger and Webb (1999) provide a good sampler of development-country oriented literature available in this area.

obligations compromises not only the market access of other states and, internationally, of the federal government, but also the banks' ability to service their deposits.

Those first- and second-order externalities make federal bail-outs of defaulting states virtually inevitable (effectively distributing the cost of the state's default among the tax-payers of all the states in the federation). This, ex-ante, generates moral hazard of two types—it fosters irresponsible borrowing by the states *and* irresponsible lending by their bankers. The danger of irresistible pressure for federal bailouts, and thus of both types of moral hazard, is increased when the borrowers are sub-national governments with service provision responsibilities that are important to the national government, such as primary schooling and police protection. This is typical of developing countries, like Mexico, where political expediency hastened expenditure decentralization without prior establishment of an adequate regulatory framework for state and municipal borrowing.

This paper describes and analyzes Mexico's innovative approach to regulating sub-national bank borrowing. It starts by presenting the context in which that approach was introduced in April 2000 as well as the regulatory regime's main policy components. A theoretical model is then developed to examine the economic underpinnings of the regime, and is simulated under various parametric structures. This helps identify the main conditions for Mexico's sub-national bank borrowing regulation to achieve its core objective, namely, to minimize the cost of federal bail-outs while fostering efficiency-enhancing, risk-based interest rate differentiation across sub-national borrowers. Three such conditions are shown to be critical: (i) the market credibility of the federal commitment not to bail-out defaulting sub-nationals; (ii) the sub-nationals' access to

financing other than bank loans; and (iii) the quality of the enforcement of bank capital rules.

### **Sub-national Borrowing in Mexico: The Initial Position**

Sub-national debt in Mexico has so far not been a national macroeconomic problem (as it has in Brazil for example), but it could rapidly become one. In 1997, the recorded stock of state and municipal debt was equivalent to about 2 percent of Mexico's GDP (and about 6 percent of total public debt).<sup>3</sup> By comparison, sub-national debt amounts to 5 percent of GDP in Argentina, almost 20 percent in Canada, and somewhat above that level in Brazil. In addition, the Mexican constitution prohibits states from borrowing in foreign exchange or from foreign creditors.

Behind Mexico's relatively comfortable sub-national debt statistics, however, lie three potential destabilizing factors—moral hazard, limited actual servicing capacity, and contingent liabilities. Prior to the 1990s the federal government, through the governing party's infrastructure, had control over the state governments, and thus ultimately over any state borrowing decisions. Over the course of the 1990s, rapid democratization ended much of this federal political control, which allowed states to take advantage of the federal government's concern for both the banking system (which, following its 1995 crisis, had

---

3. Most Mexican states have much less disposable income to service debt than usual accounting would suggest, since much of their current expenditures is "tied" to *de facto* inflexible commitments (notably salaries). The ratio of debt stock to disposable revenue, the latter defined as own taxes plus untied transfers, ranges from a maximum of 1.8 (in Sonora) to a minimum of 0.02 (in Hidalgo). By that measure, the eight most indebted states are Sonora, Nuevo León, México, Querétaro, Quintana Roo, Baja California Sur, Jalisco, and Sinaloa, all with a ratio of debt stock to disposable revenue greater than 1 (Hernandez and Oliveira, 2000).

problems of its own) and for the ability of states to continue delivering important public services which had been decentralized.

Indeed, both states and banks in Mexico had witnessed many federal bailouts in the past and had come to expect them, thus making borrowing a means through which states could obtain extra federal resources transferred to them directly or through their creditors. The federal government's capacity to deliver those transfers was embedded in its annual budget through a special and often large line-item to be allocated at the Executive's discretion (especially within *Ramo 23*). All states received bailouts in the wake of the 1995 crisis, and a few states have received bailouts since then when guarantees came due on large infrastructure projects.

Perhaps more importantly, the federal government's practice of accepting state *mandatos* (mandates) to act as a trustee in servicing state debt that had been collateralized with *participaciones* (revenue sharing) became a *de facto* pre-condition for states to have access to credit markets, not just because of the value of the collateral but because of the perceived blessing and guarantee by the federal government. Legally, a *mandato* became a perfect "intercept" for the lenders, whereby the federation would automatically pay back bank loans out of the *participaciones* that would otherwise correspond to the debtor state, before the monies could reach that state and, thus, without violating its constitutional jurisdiction.

Not surprisingly, few commercial banks developed their institutional capacity to assess sub-national lending, even though they have been active in this market. Structural problems in the financial markets that were exposed in the aftermath of the 1995 banking crisis (e.g., weak commercial guarantee and bankruptcy laws; limited judicial capacity)



drove banks away from private borrowers and toward secured lending possibilities with federal and state government entities. The existence of a *régimen de excepción*, whereby usual regulatory limits to single-customer exposure (concentration limits) did not apply to loans given to sub-national governments made those possibilities all the more attractive.

In sum, the combination of sovereign states ability to make independent borrowing decisions along with increasing expenditure responsibilities, banks with a need for secured lending options, and a federal government with a track record of acting as last-resort lender put Mexico in an uncomfortable position with regard to sub-national liabilities and their potential impact on the country's macroeconomic stability.

### **A New Approach to Sub-national Borrowing Regulation**

To reverse the situation, Mexico's federal government faced the challenge of both imposing *ex-ante*, market-based mechanisms that would prevent excessive sub-national borrowing and at the same time convey a credible signal that it would not, *ex-post*, bail-out the parties involved in such borrowing. In response to this challenge, it introduced in late 1999 (with full effect as of April 2000) a new regulatory framework for debt management by the states and municipalities. This framework is made up of the following six components:

1. A renunciation, and ensuing removal from the federal budget for 2000, of the Executive's power for discretionary transfer. Naturally, this policy proved uncontroversial with the opposition-dominated Congress.
2. The abolition of the *mandatos*. This left the states and their creditors to make their own *fideicomiso* (trust) arrangements for the collateralization of debt with

*participaciones* or other revenue flows, assuming the legal risks involved and without recourse to the federation.

3. The elimination of the so-called *régimen de excepción* to single-customer exposure ceilings. This limits the extent of financial-sector damage that one single state can cause and signals that state debt must be evaluated on a basis similar with other debt.
4. The establishment of a link between the capital risk weighting of bank loans to sub-national governments and those governments' credit rating. In particular, two, current, published, global-scale local-currency credit ratings performed by internationally reputable credit rating agencies are to be used by bank regulators to assign capital risk weightings (between 20 and 115 percent) to loans given to state and municipalities. The rules for assigning these weights are fully specified by regulation.

This innovative scheme, which is in line with the Basle Committee's recommendations of June 1999, is based on the distance between the rating obtained by the sub-national borrower in question and the rating of the local-currency debt of the federal government. To control for agency shopping, two ratings are called for by the regulation and, in case of large discrepancies (more than two grades of distance), the capital weighting of the worse rating applies.

The purpose of these regulations is, of course, to make the pricing of bank loans a function of the underlying risk of the sub-national borrower, especially in the new framework characterized by the absence of federal intervention. Financially weaker states are likely to be priced or rationed out of the market (and become conditional

clients of the development banks—see below), while stronger states would see the price of loans fall.

5. Registration of sub-national loans with the federal government was made conditional upon the borrowing state or municipality being current on its publication of debt and associated fiscal statistics from the preceding year's final accounts, and on all of its debt service obligations toward the Government's development banks. At the same time, and to make that registration appealing, unregistered loans are automatically risk weighted by the regulators at 150 percent. This additional incentive to achieve transparency has the purpose of ensuring that private contracting between the sub-national borrowing and the credit rating agencies does not lead to the withholding of a minimum of quantitative information on borrower finances. Ultimately, the discipline on these governments will arise only if voters and opposition parties have access to full information about the fiscal behavior of the administration in office.
6. Finally, and as a matter of corporate policy, federally-owned development banks are to make new loans to states and municipalities only when the loan in question qualifies for registration and its corresponding capital risk weighting is less than 100 percent. This policy, coupled with the previously mentioned conditions for registration, makes the development banks part of the rigor of the new regulatory scheme, rather than allowing them to function as a potential loophole.

Lending to weaker sub-nationals is not forbidden, after all, these are the clients whom the development banks are mandated to assist. Instead, sub-national loans with risk weightings of more than 100 percent are allowed if the loan package

contains a technical assistance component funded by an international development bank. This latter arrangement conveys the signal that, when the loan is particularly risky (and correspondingly expensive), its origination and supervision is subject to a neutral, independent party.

### **The Theory Behind the Rules**

How does Mexico's regulatory environment for sub-national bank borrowing work, that is, provide incentive for interest rates to reflect the creditworthiness of the borrowers and reduce the expected cost of federal bail-outs? This section addresses that question by developing and simulating a simple, one-period model of interest rate determination in the sub-national loan market. Rational, profit-maximizing banks operating in competition will be shown to generate interest and bail-out cost outcomes that critically depend on the perceived (not necessarily the declared) attitude of the federation toward bail-outs; the existence of alternate means of financing for sub-national governments; and the quality of banking supervision. This sets up the stage for simulating the effect of Mexico's new regulations under various parametric structures.

The model will assume that, at the beginning of the period, the representative bank ignores what the repayment capacity or asset value,  $A$ , of the sub-national borrower will be at the end of the period, when the loan must be repaid. It knows, however, that there are two possible outcomes for  $A$ : a high value,  $A_H$ , and a low value,  $A_L$ , which is some proportion,  $p$ , of the high value, so that  $A_L = p \cdot A_H$ , where  $0 < p < 1$ . For simplification, and with no loss of generality,  $A_H$  is here normalized so that  $A_H=1$  and  $A_L=p$ . Thus,  $A = \{A_L, A_H\} = \{p, 1\}$ . The probability of a low outcome,  $\sigma \in [0,1]$ , is also known to the

bank. In practice,  $A$  can be thought of as the ex-post capacity of a borrowing state or municipality to repay its debts, a variable usually associated with, among others, local business cycles and fiscal efforts.

Three other factors will play a critical role in the bank's sub-national lending decision: a) the portion of the loan's service that the federal government is expected to bail out,  $m \in [0,1]$ ; b) the capital risk weighting,  $w \in [0,+\infty)$ , required by the regulations for bank loans to states and municipalities; and c) the quality of banking supervision, denoted here by  $q \in [0,1]$ , i.e., the resulting effectiveness with which capital risk weighting regulations are enforced. The three factors are at the core of Mexico's new regulatory system for sub-national borrowing. By renouncing its powers to execute discretionary transfers in its budget for the year 2000 (and, supposedly, thereafter), the federal government vastly reduced, if not eliminated, the perception that it would bail-out sub-nationals that default on their debt. By linking capital risk weights to credit ratings, the value of  $w$  varies across states and municipalities, rather than being uniform for all loans to sub-national governments. Finally, through a package of reforms put in motion in September 1999, rules for bank capital formation and accounting were brought up to internationally accepted standards and are gradually being enforced<sup>4</sup>.

Given these framework conditions, a form for the supply of bank loans to sub-national governments,  $L^s$ , can be developed. Equation (1) and (2) below, define the expected revenue and expected cost of the representative bank in the one-period sub-national loan market:

---

<sup>4</sup> For a description of the September 1999 banking reforms, see the website of La Comisión Nacional Bancaria y de Valores <http://www.cnbv.gob.mx/index.htm>.

$$E[R] = (1 - \sigma) \cdot L^s \cdot i_l + \sigma \cdot m \cdot L^s \cdot i_l \quad (1)$$

$$E[C] = L^s \cdot i_d + q \cdot w \cdot \rho \cdot L^s + \sigma \cdot (1 - m) \cdot (L^s - A_L) \quad (2)$$

where  $i_l$ ,  $i_d$ , and  $\rho \in (-\infty, +\infty)$  are the loan interest rate, the deposit interest rate and the return on the bank's equity (or opportunity cost of capital), respectively.

Equation (1) states that the expected revenue of the bank is not only a function of the risk of default by the sub-national borrower, but also of the portion,  $m$ , of the loan that the federal government is expected to bailout if default takes place. As  $m$  approaches 1, the moral hazard inherent in the market increases, and thus it is more likely that the lenders will receive their due revenue in full, or simply  $E[R] = i_l$ . Similarly, Equation (2) argues that the expected cost of the loan depends on the cost of funds, the cost of fulfilling capital risk weighting regulations (given the quality of enforcement)<sup>5</sup> and, in the event of default, the portion of the unpaid balance (that is, the loan's principal minus the low asset value,  $A_L$ ) *not* bailed out by the federal government.<sup>6</sup> If there is close to perfect moral hazard,  $m \rightarrow 1$ , and no capital risk weighting requirements exist,  $w \rightarrow 0$ , or the quality of their enforcement is poor,  $q \rightarrow 0$ , the expected per unit cost of the loan approaches the deposit interest rate,  $E[C] \rightarrow i_d$ .

Assuming that the market for loans is competitive, i.e., equilibrium is characterized by no supra-normal profits and  $E[R] = E[C]$ , the following implicit function for the supply of loans obtains from equations (1) and (2):

---

<sup>5</sup> We adapt the middle term of Equation (2) from Lévy-Garboua (1993).

<sup>6</sup> Note that  $E[A] = \sigma \cdot A_L + (1 - \sigma) \cdot A_H$ . However, since the bank would never lend more than  $A_H$  (net of interest), it will, in the event of a high outcome, recover its principal and make its return on the loan,  $L \cdot i_l$ , in full. Thus only  $A_L$  factors into the expected cost function.

$$i_l = i_d + qw\rho + \sigma(1-m)\left[(1+i_l) - \frac{A_L}{L^s}\right] \quad (3)$$

In addition to the cost of funds and the cost of fulfilling the regulatory requirements, the supply price of a one-dollar loan is implicitly determined by the portion of the loan's gross revenue that the bank does not expect to recover per dollar lent. Equation (3) can be rearranged into the following:

$$i_l = \frac{1}{\delta} \cdot \left[ i_d + qw\rho + \sigma(1-m)\left(1 - \frac{A_L}{L^s}\right) \right] \quad (4)$$

where  $\delta = 1 - \sigma(1-m) > 0$ . It can then be shown that:  $\frac{\partial i_l}{\partial m} < 0$ ,  $\frac{\partial i_l}{\partial \sigma} > 0$ ,  $\frac{\partial i_l}{\partial A_L} < 0$ , all

reasonable characteristics of a supply function for sub-national loans. States and municipalities will pay less for their loans the higher the chances that the federation will bail them out, the lower the probability of bad asset outcome, and the higher their asset value when a bad outcome materializes.<sup>7</sup>

To complete the model, the demand for sub-national loans is assumed as a simple linear function of the interest rate:

$$L^D = \alpha - \beta \cdot i_l \quad (5)$$

The additional restriction,  $\alpha = A_H$ , is added to the model as a sub-national government can borrow no more than the high value of its asset.<sup>8</sup>

<sup>7</sup> Note that the usual marginal cost equal marginal revenue condition for profit maximization yields the following solution for the interest rate,  $i_l = \frac{1}{\delta} \cdot [i_d + qw\rho + \sigma(1-m)]$  which is the same as total revenue equal total cost approach solution above as  $L^s \rightarrow \infty$ .

<sup>8</sup> Another way to rationalize that restriction is as follows. Sub-national governments are not able to borrow more than the expected value of their asset. At the same time, for interest rates to be zero, a necessary condition is that risk be zero. In that case,  $E[A] = \sigma \cdot A_L + (1-\sigma) \cdot A_H$ , and since  $A_H=1$ , then  $\alpha = E[A] = 1$ , when  $\sigma=0$ .

Equating supply (4) and demand (5), and after some rearrangement, the following quadratic function for the equilibrium interest rate is:

$$i_l^2 \beta \delta - i_l (\delta \alpha + \beta \phi) + \alpha \phi - \gamma = 0 \quad (6)$$

where  $\gamma = \sigma(1-m)A_L$  and  $\phi = i_d + q\omega\rho + \sigma(1-m)$ .<sup>9</sup> The solution for (6) yields two distinct real roots<sup>10</sup>. The analysis here is confined to the root which yields positive interest rates and loan quantities. This root and, thus, the equilibrium interest rate solution is given by:

$$i_l = \frac{1}{\beta \delta} \cdot \left( \alpha \delta + \beta \phi - \left[ 4\beta \delta (\gamma - \phi \alpha) + (-\alpha \delta - \beta \phi)^2 \right]^{1/2} \right) \quad (7)$$

### Simulating the Effect of the New Rules

This section employs Equation (7) to simulate the effect of changes in demand and policy parameters on the equilibrium interest rate, quantity of loans, and expected cost of bail-outs by (and to) the federal government. This expected cost is determined by:

$$E[C] = m(L(1+i_l) - A_L) \cdot \sigma \quad (8)$$

<sup>9</sup> The existence of an interior solution in quadrant I, and hence, an equilibrium for the supply and demand for funds requires that  $\alpha > \frac{\gamma}{\phi}$ . This is found by noting that  $\lim_{i_l \rightarrow 0} L^S = \frac{\gamma}{\phi}$ , which is the horizontal intercept of the supply function, must be less than  $\alpha$ . This condition is necessary and sufficient for an equilibrium with positive  $i$  and  $L$ , and implies that the interest rate never exceeds the positive asymptote,  $\frac{\phi}{\delta}$ .

<sup>10</sup> The condition for the existence of two distinct real roots is  $\phi = [(\delta \alpha + \beta \phi)]^2 + 4\beta \delta (\gamma - \alpha \phi) > 0$



That is, the federal government expects to pay a portion,  $m$ , of the difference between the loan repayment amount and the state's low-value asset, with probability  $\sigma$ . If the high asset value materializes, no federal outlay is required.

Alternative regulatory regimes enter the expected bail-out cost via their effect on interest rates, yet, changes in interest rates have an ambiguous effect on the expected cost, which is shown to depend on the elasticity of the demand for loans.<sup>11</sup> For example, higher capital risk weighting requirements, assuming  $q > 0$  and  $\rho > 0$ , will increase equilibrium interest rates, and for a demand curve with non-zero elasticity, reduce the loan quantities. The combined effect, in terms of expected bail-out, hinges on the parametric values of the capital risk weighting variable,  $w$ , the elasticity of the demand for loans,  $-\frac{\beta i_l}{\alpha - \beta i_l}$ , and the moral hazard proxy,  $m$ .

Four basic policy scenarios are simulated here: (i) banking regulations which require no capital risk weighting of sub-national loans, so that  $w = 0$  (an arrangement not uncommon in countries where the federation is perceived as the guarantor of state and municipal borrowing and, thus, sub-national loans are considered riskless); (ii) a uniform, but low capital risk weighting scheme for all sub-national loans independent of their risk;

---

<sup>11</sup> The ambiguous interest rate effect on expected cost can be seen by differentiating (9) with respect to the rate of interest:

$$\frac{\partial E[C]}{\partial i_l} = \sigma m [\alpha - \beta(2i_l + 1)] \quad (9')$$

If  $\beta \geq 1$ , the impact of higher interest rates on the expected cost of federal bail-outs is unambiguously negative. If  $\beta < 1$ , the sign of (9') becomes ambiguous. Letting  $C(i_l, \beta)$  denote a set of interest rate and  $\beta$  pairs, for  $\beta < 1$ , then plainly, there are an infinite number of  $C(i_l, \beta)$  which could either make (9') negative or positive. The sign on (9') is determined by whether  $i_l$  dominates a given value of  $\beta$  thus making the expected marginal cost of interest changes negative. On the other hand, a  $\beta < 1$  may dominate any value of  $i_l$ , so that  $[\alpha - \beta(2i_l + 1)] > 0$ , leaving (9') positive and increasing the expected cost of the government when interest rates rise.

(iii) a similarly uniform but high capital risk weighting scenario called for by regulation; and (iv) regulation which makes capital risk weightings a function of the underlying risk as measured, for example, by independent credit rating agencies (this is the essence of Mexico's new regulatory system).<sup>12</sup> For each regulatory scenario (that is, for each value of  $w$ ), three different levels of moral hazard are simulated ( $m=1$ ,  $m=0.5$  and  $m=0.05$ ), each reflecting a different perceived federal attitude toward bail-outs.<sup>13</sup> Finally, two varying degrees of demand elasticity are employed (embedded in the value of  $\beta$ ), implying either a relatively inelastic or a relatively elastic demand for sub-national loans. Table 1 shows the exact values (or, when relevant, functional form) given to  $w$ ,  $m$ ,  $\beta$  and the other parameters in the simulations.

Figures 1 through 6 illustrate how the various combinations of parametric structures interplay to determine changes in interest rate and expected bail-out cost as the underlying borrower risk,  $\sigma$ , varies. The figures express expected bail-out cost as a proportion of the loan's principal-plus-interest, measured in basis point units over the corresponding cost when zero capital risk weighting is required<sup>14</sup>. In other words, the figures show the *basis point differential cost* of any given regulatory regime over an arrangement in which sub-national bank borrowing is, for regulatory purposes, automatically considered risk-free. Thus, when a differential cost series slopes upward,

---

<sup>12</sup> For the simulations in scenario (iv), the Basel Committee's recommendations for the level of capital risk weighting according to risk of default are employed. For a detailed description of the weightings, see the Basel Committee's Report, *A New Capital Adequacy Framework*, p. 29-32.

<sup>13</sup>  $m=0.05$ , rather than  $m=0$ , is use here as a proxy for a no-bail-outs situation, since the case of  $m=0$  is trivial in that, there are by definition zero expected costs to the federal government.

<sup>14</sup> Cost as a percent of the loan and interest is given by:  $c = \sigma m \left[ 1 - \frac{A_L}{L^e (1 + i_t)} \right]$

**Table 1**  
Parameter Values for Simulations

<i>Parameter</i>	<i>Value</i>
$A_L$ , low asset value	0.5
$i_a$ , cost of funds	0.05
$q$ , quality of supervision	0.9
$w$ , capital risk weight	
None	0.0
Uniformly Low	$0.08 \times 0.2$
Uniformly High	$0.08 \times 1.15$
Function of Risk	$0.08 \times (0.2 + \sigma)$
$\rho$ , bank's return on equity	0.1
$m$ , moral hazard	
High (perfect)	1.0
Intermediate	0.5
Low	0.05
$\beta$ , elasticity parameter	
Inelastic	0.5
Elastic	5.0
$\sigma$ , risk	(0,1)

this is to be interpreted as a regime which, for a given level of risk, is more costly to the federal government than no risk weighting requirements. Similarly, interest rates are shown as the basis point difference between the interest rate prevailing in a given regulatory regime over the interest rate that applies under zero capital risk weighting.<sup>15</sup>

*i) Inelastic Demand*

As shown in Figure 1-a and 1-b, a relatively inelastic demand for loans and high moral hazard are the worst possible combination from the point of view of federal government. In that scenario, introducing regulations that seek to penalize uncreditworthy (risky) sub-national borrowers is, in effect, self-defeating. This is because the increase in interest rates caused by a tighter link between capital risk weighting and underlying risk does not generate a large enough contraction in the equilibrium quantity of

loans. Although stricter regulation makes credit more expensive, states and municipalities do not reduce the quantity demanded of loans sufficiently and the moral-hazard-prone federal government faces a large expected bail-out bill. The riskier the sub-national in question, the larger that expected cost.

Why does credit become more expensive in the first place? The reason is that the introduction of capital risk weighting requirement increases the cost of lending to the banks and, in competitive markets, they pass the higher per unit cost to their borrowers. Notice that, when compared to the non-weighted scenario, the increase in interest rates occurs even though there is ‘perfect’ moral hazard (that is,  $m = 1$ ) and the federal government is expected to bail out in full. However, risk-based interest rate differentiation only occurs when the regulatory link between capital risk weighting and risk assessments (that is, credit ratings) is enforced.

As moral hazard shrinks (that is, the value of  $m$  falls), the differential cost of introducing positive capital risk weighting decreases across possible regulatory regimes (Figures 2a and 2b). Now that the federal government is less willing to pick up the expected cost of defaults, banks do not expect a full bail-out and subsequently increase interest rates more steeply in line with risk. But, given the inelastic demand for funds by states and municipalities this increase in interest rates results in a relatively small contraction in the quantity demanded for funds. Partial federal willingness to bail out ( $m < 1$ ) also achieves another important result –banks begin to differentiate interest rates across borrowers even in the case when capital risk weighting coefficients are constant.

---

<sup>15</sup> Note that:  $i_t^{nw} < i_t^w$ , since  $\phi^{nw} = i_d + \sigma(1 - m) < \phi^w = i_d + qw\rho + \sigma(1 - m)$ ; where the subscripts,  $nw$ , and  $w$ , respectively denote, *non-weighted* and *weighted*.

Finally, when lenders are left to shoulder the burden of any default (a situation simulated by  $m = 0.05$ ), both interest rate differentiation takes place across all regulatory regimes and, naturally, expected bail-out costs are minimized. Banks now fully price-in the risk embedded in their sub-national loans, either because of the possibility of deeper capital losses from defaults, or because the regulation imposes a link between risk and capital risk weighting, or both. At high levels of risk, heftier loan prices reduce loan size by so much relative to the asset value of the borrower in default ( $A_L$ ) that the resulting decline in the bank's exposure tempers, and eventually reverses the rise in interest rates differentials compared with the regime where no capital risk weighting requirements exist. Graphically, interest rate differentials peak before risk (see Figure 3-a). Correspondingly, the expected bail-out cost is also hump-shaped, and as risk approaches one (that is, default becomes almost certain), the cost becomes lower when non-zero capital risk weighting exists (the curves in Figure 3-b become negative). This outcome is noteworthy; at high levels of risk, adequate regulation and credible renunciation of bail-outs can reduce the relative, ex-ante cost to the federal government of sub-national defaults, even if the demand for loans by states and municipalities is inelastic.

It should additionally be noted that, for each level of moral hazard, the quality of regulatory enforcement,  $q$ , acts as a filter to the impact that the choice of capital risk weighting regime has on interest rates and expected bail-out costs. Mathematically, a functional form for  $q$  can be found that renders various regimes equivalent. For example, poor perceived regulatory enforcement ( $q < 1$ ) can make the high-but-uniform capital risk weighting equivalent to a low-but-uniform regime, from the bank's decision point of view ( $q = w_{low} / w_{high}$ ). As  $q$  approaches 0, the interest rates on loans for a given level of  $m$  shift

down across all levels of risk and converge to the no capital risk weighting scenario. In line with interest rates, expected bail-out costs also converge to the no capital risk weighting scenario as  $q$  declines. Additionally, and seemingly somewhat counterintuitive, when the demand for loans is inelastic, better regulatory enforcement (which in practice is a federal responsibility) raises the expected bail-out costs to the federal government, as the proportional increase in interest rates is larger than the reduction in loan quantities. This perverse partial-equilibrium result, of course, ignores the economy-wide benefits of risk-based interest rate differentiation.

## *ii) Elastic Demand*

Enforcing capital risk weighting of sub-national loans through regulation yields better results, in terms of reducing the expected cost of federal bail-outs, when the demand for those loans is elastic. These simulations are depicted in Figures 4 through 6, where  $\beta = 5$  (rather than  $\beta = 0.5$ ).

The change in the interest rate sensitivity parameter ( $\beta$ ) has no effect upon the behavior of interest rates when the federal government is expected to bail out in full,  $m = 1$  (compared Figure 1-a to 4-a). Yet, the increase in interest rates caused by the introduction of capital risk weighting requirements now leads to a more than proportional contraction in the demand for loans, thus reducing the expected cost of bail-outs compared to the situation in which capital risk weighting is zero. The cost reduction is more pronounced, the higher the level of underlying risk. Graphically, the three curves in Figure 4-b slope downward throughout a negative range of values.

An enhanced demand elasticity does change the pattern of differential interest rates when full bail-outs are not expected,  $m < 1$  (compare Figures 5-a and 6-a to 2-a and 3-a,

respectively). In this case, the enforcement of positive capital risk weighting regulations raises interest rates but, as risk increases, the more than proportional reduction in loan demand reduces the bank's exposure vis-à-vis the low asset value,  $A_L$ . This makes the interest rate differential in favor of the no capital risk weighting scenario fall continuously as risk expands. The downward sloping functions in differential interest rates reinforces the expected saving in bail-out costs that accrues to the federal government as a result of introducing compulsory capital risk weighting requirements (Figures 5-b and 6-b).

Improvements in regulatory enforcement play a more constructive role when the demand for sub-national loans is relatively elastic, compared to the inelastic case discussed previously. As  $q$  increases, pushing up interest rates and reducing loan quantities more than proportionally, the expected cost of federal bail-outs diminishes. While  $q$  still acts as a filter that can weaken the effect of various credit weighting regimes, the federal authorities now have a partial-equilibrium incentive to ensure that states and municipalities abide by the regulations

## **Conclusions**

In April 2000, Mexico's federal government introduced a new approach to regulate sub-national bank lending in the country. That approach consists of two main components: the renunciation by the federal authorities of their discretionary powers to bail-out states and municipalities, and the introduction through regulation of a link between capital risk weighting of sub-national bank loans and the underlying risk of the borrower (as assessed by credit rating agencies).

This paper describes the new regulatory regime and constructs a model to explain its theoretical underpinnings, and then simulates that model under various parametric structures. Highlighted here, is the critical role that the *perceived commitment* of the federal government to not bail-out defaulting states and municipalities plays in the success of the new regime. When the elasticity of the demand for sub-national loans is low, the new regime is likely to be counterproductive in terms of expected federal bail-out costs if not accompanied by a credible commitment to refrain from bail-outs. If instead, demand elasticity is high, introducing a link between capital risk weighting and actual risk is always beneficial in that it reduces the expected cost of federal bail-outs vis-à-vis a no capital risk weighting scenario.

More generally, for whatever degree of demand elasticity, and even in the case where the federal government is expected to bail out in full, a regulatory link between capital risk weighting and borrower creditworthiness translates into efficiency-enhancing interest rate differentiation across sub-national borrower given at least a minimum of competence in enforcing those regulations.

Although the model developed in this paper is, by design, static and does not accommodate reputational considerations, it helps highlight the importance of sound creditworthiness assessments in the determination of risk-based capital risk weightings. The theory behind the simulations employs a linear link between risk and capital risk weightings. In practice, and as in Mexico's new regulatory regime, that link is likely to be provided by independent credit rating agencies operating under a private contract with the prospective sub-national borrowers. The agencies will likely produce more accurate credit ratings, the higher their reputational exposure. In turn, this exposure will be heightened by



the possibility of comparing ratings by the same agencies across a large number of sub-national clients within, and especially, outside the country in question. For this reason, it seems paramount that, as a matter of regulation, the ratings required to calculate the capital risk weighting of bank loans be done on global, rather than country-specific scales. In Mexico, both scales are acceptable from the regulatory stand-point and the choice between scales is left to market forces (fees, signaling needs, and the like).

The analytical framework presented here has three main limitations. The model ignores general equilibrium effects, notably the fact that sub-national borrowing may be directed to investment opportunities with national externalities, thus reducing the economic, rather than financial, cost of federal bail-outs. Also, the supply function for loans assumes away the possible importance of the non-lending business that banks may be providing to sub-national governments (e.g., payroll management). This is something that may effectively reduce the cost of lending to a certain customer and therefore could limit risk-based interest rate differentiation even in the presence of regulation. Finally, the elasticity of the demand for loans may prove endogenous to the regulations, as states and municipalities priced out of the bank loan market due to risk-driven high capital risk weighting requirements are unlikely to be able to access bond or other financing markets.

While those limitations are important, we focus on the general policy conclusions of the paper, namely, that the success of Mexico's new regulatory system for sub-national borrowing will depend on a series of market and demand factors but, more critically, it will be determined by the credibility of the federal government's commitment to renounce bail-outs.

figures 1 to 3:  
Relatively Inelastic Demand for Subnational Loans:  $\beta=0.5$

Figure 1-a: Interest Rates  
 $m=1.0$

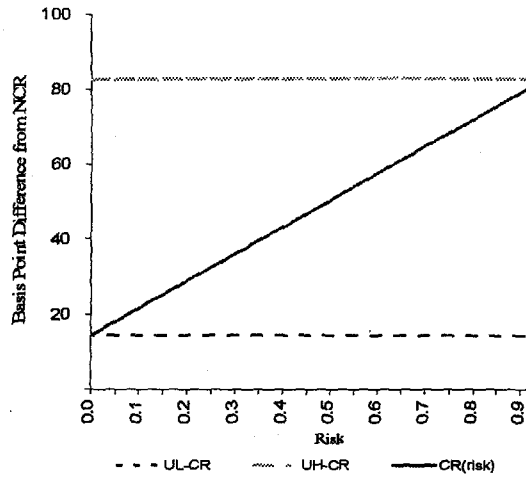


Figure 2-a: Interest Rates  
 $m=0.5$

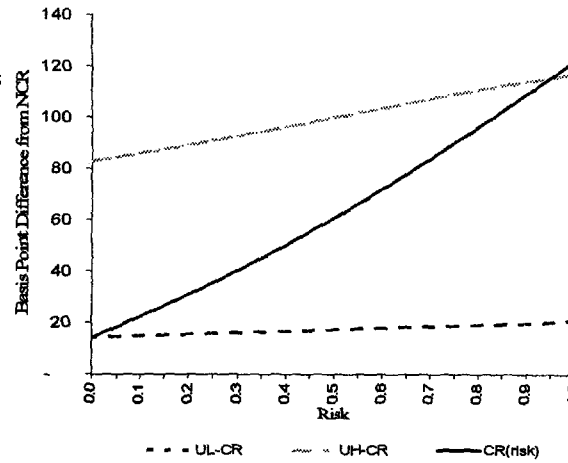


Figure 3-a: Interest Rates  
 $m=0.05$

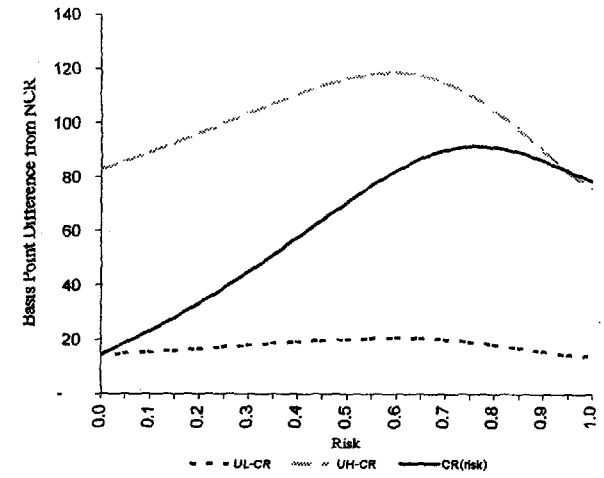


Figure 1-b: Expected Bail-out Cost:  
 $m=1.0$

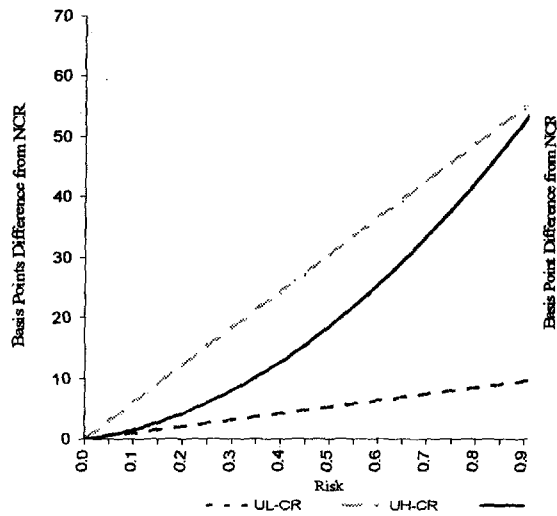


Figure 2-b: Expected Bail-out Cost  
 $m=0.5$

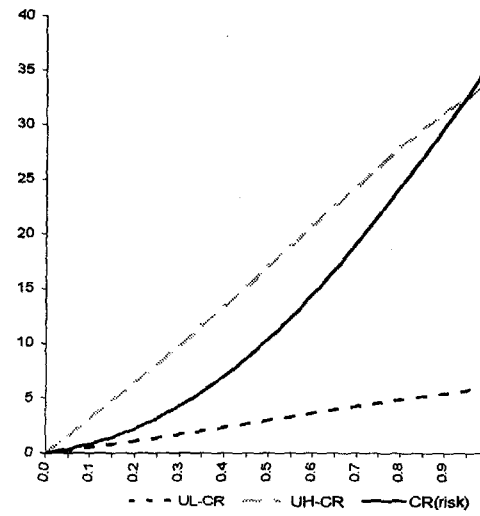
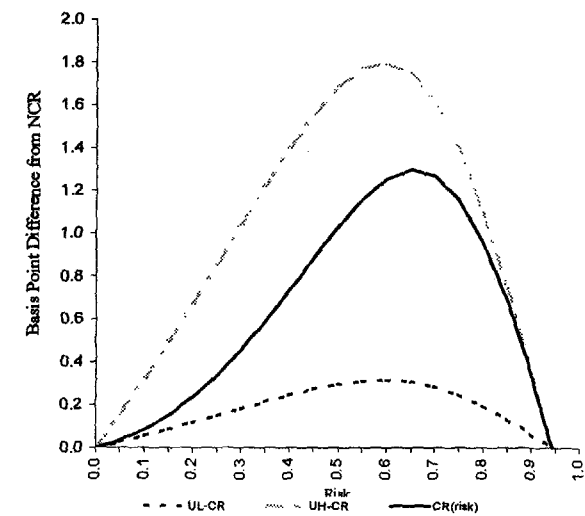


Figure 3-b: Expected Bail-out Cost:  
 $m=0.05$

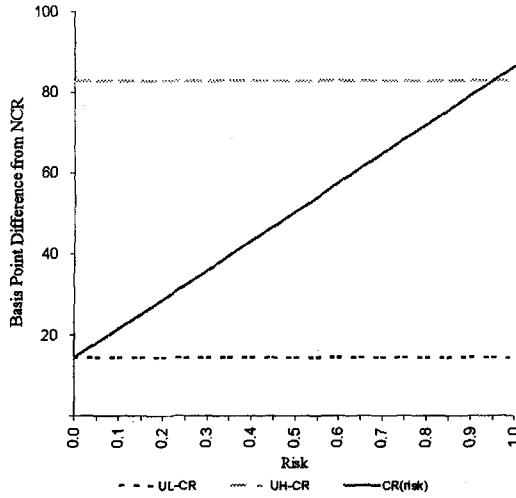


Note 1:  $AL=0.5$ ,  $id=0.05$ ,  $q=0.9$ ,  $\eta=0.1$

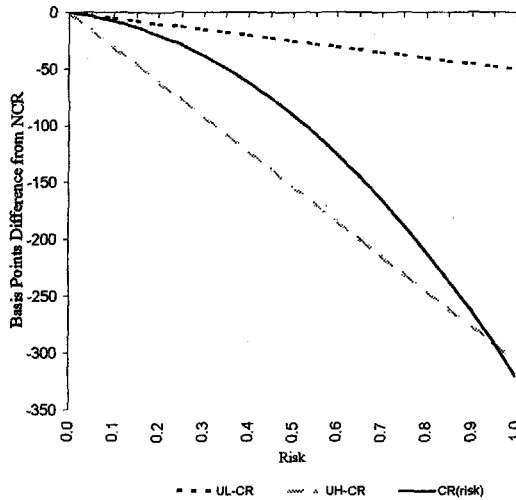
Note 2: NCR-No Capital Risk Weighting Requirements; UL-CR-Uniform Low Capital Risk Weighting Requirements; UH-CR- Uniform High Capital risk Weighting Requirements

**Figures 4 to 6:**  
**Relatively Elastic Demand for Subnational Loans:  $\beta=5.0$**

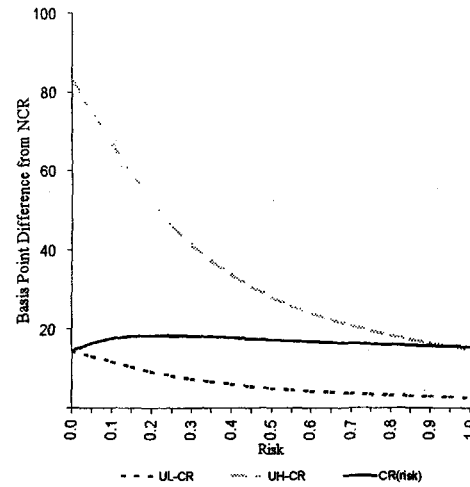
**Figure 4-a: Interest Rates**  
 $m=1.0$



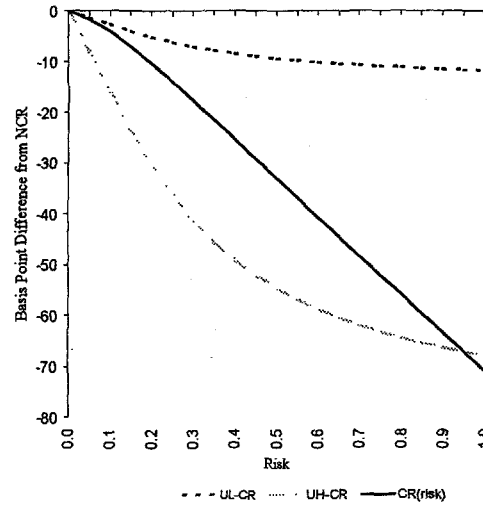
**Figure 4-b: Expected Bail-out Cost :**  
 $m=1.0$



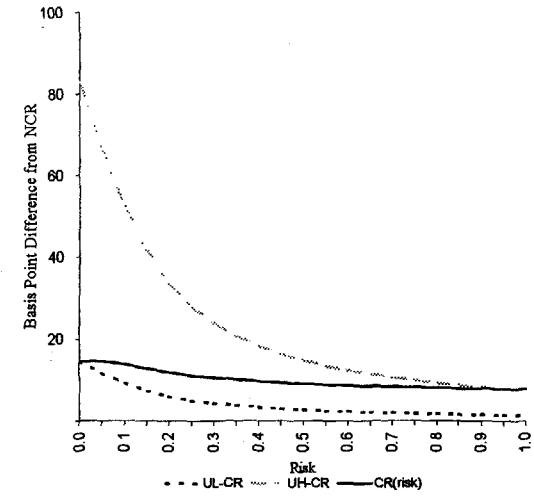
**Figure 5-a: Interest Rates**  
 $m=0.5$



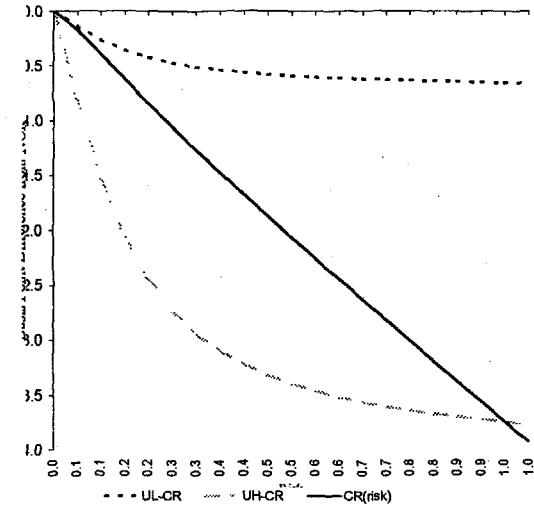
**Figure 5-b: Expected Bail-out Cost**  
 $m=0.5$



**Figure 6-a: Interest Rates**  
 $m=0.05$



**Figure 6-b: Expected Bail-out Cost :**  
 $m=0.05$



Note 1:  $AL=0.5$ ,  $id=0.05$ ,  $q=0.9$ ,  $\varphi=0.1$

Note 2: NCR-No Capital Risk Weighting Requirements; UL-CR-Uniform Low capital Risk Weighting Requirements; UH-CR- Uniform High Capital risk Weighting Requirements

## References

- Barajas, Adolfo and Roberto Steiner, and Natalia Salazar, 1998, "Interest Spreads in Banking : Costs, Financial Taxation, Market Power, and Loan Quality in the Colombian Case 1974-96." International Monetary Fund, Western Hemisphere Department. IMF working paper ; WP/98/110, p. 39-41.
- Dillinger, William, and Steven B. Webb, 1999, "Macroeconomic Management in Federal Democracies: Argentina and Brazil." *Policy and Research Working Paper Series*, No. 2121, World Bank, Washington, D.C.
- Freire, Maria, Marcela Huertas, and Benjamin Darche, 2000, "Subnational Governments and Credit Markets: Selected Cases" in Burki, Perry, *et al*, eds, *Decentralization and Accountability of the Public Sector*, Proceeding of the Annual Bank Conference on Development in Latin America and the Caribbean, World Bank, Washington, D.C..
- Hernandez, Fausto and Joao de Carmo Oliveira, 2000, "Subnational Borrowing and Debt Management," in S. Webb and M. Giugale, eds., *Fiscal Decentralization in Mexico: Achievements and Challenges*, Washington D.C., forthcoming.
- Lévy-Garboua, Vivien, 1993, "Le Ratio Cooke et Les Fonds Propres Des Banques" *Revue D'economie Financiere* (France); No. 27:47-73
- Stiglitz, Joseph, and Andrew Weiss, 1981, "Credit Rationing in Markets with Imperfect Information." *The American Economic Review*, Vol. 71, No. 3; 393-410.
- Ter-Minassian, Teresa, and Jon Craig, 1997, "Control of Subnational Government Borrowing." in Teresa Ter-Minassian, ed., *Fiscal Federalism in Theory and Practice: A Collection of Essays*, Washington, D.C.: International Monetary Fund
- Yu, Hua, 1995, "The Determinants of Interest Rate Margins: Empirical Evidence on the Canadian Banking Industry." *International Journal of Finance* (U.S.); 7, No. 4:1373-92.

# Policy Research Working Paper Series

	<b>Title</b>	<b>Author</b>	<b>Date</b>	<b>Contact for paper</b>
WPS2352	How Stronger Patent Protection in India Might Affect the Behavior of Transnational Pharmaceutical Industries	Carsten Fink	May 2000	L. Tabada 36896
WPS2353	The São Mateus-Jabaquara Trolleybusway Concession in Brazil	Jorge Rebelo Pedro Machado	May 2000	S. Van Veldhuizen 38722
WPS2354	When the Bureaucrats Move out of Business: A Cost-Benefit Assessment of Labor Retrenchment in China	Yi Chen Ishac Diwan	May 2000	M. Yafi 34649
WPS2355	Greed and Grievance in Civil War	Paul Collier Anke Hoeffler	May 2000	A. Kitson-Walters 33712
WPS2356	Bureaucratic Delegation and Political Institutions: When Are Independent Central Banks Irrelevant?	Philip Keefer David Stasavage	June 2000	P. Sintim-Aboagye 37644
WPS2357	Evaluating Carbon Offsets from Forestry and Energy Projects: How Do They Compare?	Kenneth M. Chomitz	June 2000	J. Ancrum 33512
WPS2358	Why Infrastructure Financing Facilities Often Fall Short of Their Objectives	Daniela Klingebiel Jeff Ruster	June 2000	M. Salehi 37157
WPS2359	Reducing Carbon Dioxide Emissions Through Joint Implementation of Projects	Will Martin	June 2000	L. Tabada 36896
WPS2360	Corruption and the Composition of Foreign Direct Investment: Firm-Level Evidence	Beata K. Smarzynska Shang-Jin Wei	June 2000	H. Sladovich 37698
WPS2361	The Welfare Effects of Private Sector Participation in Guinea's Urban Water Supply	George Clarke Claude Ménard Ana Maria Zuluaga	June 2000	H. Sladovich 37698
WPS2362	A Transitory Regime: Water Supply In Conakry, Guinea	Claude Ménard George Clarke	June 2000	H. Sladovich 37698
WPS2363	Would Collective Action Clauses Raise Borrowing Costs? An Update and Additional Results	Barry Eichengreen Ashoka Mody	June 2000	S. Kpundeh 39591
WPS2364	Perverse Effects of a Ratings-Related Capital Adequacy System	Patrick Honohan	June 2000	A. Yaptenco 38526

### Policy Research Working Paper Series

Title	Author	Date	Contact for paper
WPS2365 Leading Indicator Project: Lithuania	Stephen S. Everhart Robert Duval-Hernandez	June 2000	M. Geller 85155
WPS2366 Fiscal Constraints, Collection Costs, and Trade Policies	Keiko Kubota	June 2000	L. Tabada 36896
WPS2367 Gender, Poverty, and Nonfarm Employment in Ghana and Uganda	Constance Newman Sudharshan Canagarajan	June 2000	M. Clarke 31752
WPS2368 Seeds of Corruption: Do Market Institutions Matter?	Harry G. Broadman Francesca Racanatini	June 2000	S. Craig 33160
WPS2369 How the Proposed Basel Guidelines On Rating-Agency Assessments Would Affect Developing Countries	Giovanni Ferri Li-Gang Liu Giovanni Majnoni	June 2000	E. Mekhova 85984